OECD publishing

DATA SHAPING FIRMS AND MARKETS

OECD DIGITAL ECONOMY PAPERS
December 2022 **No. 344**

OECD
BETTER POLICIES FOR BETTER LIVES

Foreword

This report analyses how firms use data, and how that use shapes markets. It presents policy lessons to encourage the more even use of data in the business population, which is necessary to realise the potential of data for growth and well-being.

This report was drafted by Angela Attrey and James Mancini, under the guidance of Antonio Capobianco and Jeremy West, and the supervision of Audrey Plonk, Head of the OECD Digital Economy Policy Division. The report benefits from the input and research of focal points across the OECD Secretariat, including the Directorate for Science, Technology and Innovation (Sara Calligaris, Flavio Calvino, David Gierten, Simon Lange and Vincenzo Spiezia), the Centre for Entrepreneurship, SMEs, Regions and Cities (Marco Bianchini, Lucia Cusmano, Sandrine Kergroach and Lora Pissareva), the Directorate for Financial and Enterprise Affairs (Oliver Garrett-Jones and Iota Nassr) and the Economics Department (Lilas Demmou). The insights from participants of the virtual OECD Workshop "Data Shaping Firms and Markets", held on 11 May 2022, are gratefully acknowledged. Angela Gosmann and Mark Foss provided editorial support. This publication is a contribution to IOR 1.3.1.2.3 of the 2021-2022 Programme of Work and Budget of the Committee on Digital Economy Policy.

This report was approved and declassified by the Committee on Digital Economy Policy on 27 September 2022 and prepared for publication by the OECD Secretariat.

This publication is a contribution to Phase III of the OECD Going Digital project, which aims to provide policy makers with the tools they need to design and implement better data policies to promote growth and well-being.

For more information, visit www.oecd.org/going-digital.

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DSTI/CDEP/GD(2022)8/*FINAL*

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Overview

Firms are at the forefront of digital transformation and drive production, innovation and the greater deployment of digital technologies into economies and societies. As digital transformation progresses, how firms use data, and how that use affects markets and influences competitive dynamics, has risen to the top of policy agendas. Increasing the ability of the full business population to thrive in the digital environment and use data more productively is instrumental to long-term prosperity and welfare. This report analyses how data can shape firms and markets, and draws policy lessons.

Findings

Too few firms use data, despite data's proven potential to improve productivity, enhance innovation and foster new business models

Using data is transformative for firms. Empirical evidence shows that data can boost innovation and increase efficiency. Highly data-driven business models, including online platforms and distributed ledger technology applications, highlight this transformative potential. Yet still too few firms use data, with small and medium-sized enterprises (SMEs) falling behind: the most recent data indicate the share of large firms performing big data analysis is three times that of their smaller counterparts. Notably, these gaps are higher for data analytics than for other digital technologies, like electronic invoicing or social media. Although the COVID-19 pandemic spurred digitalisation in SMEs, there is little evidence to show the disparity in technology adoption between smaller and larger firms has decreased.

Uneven use of data in the business population has broader economic effects

Data are an intangible asset – namely an asset without a financial or physical embodiment that can be used to produce positive economic value. Gaps in the use of data and other intangible assets between firms appear to have broader macroeconomic effects. Large and growing gaps in the productivity of firms within intangibles-intensive industries appear to reflect the emergence of a group of highly digitalised and data-driven firms at the technological frontier and a long tail of firms, including SMEs that lag behind. Industry concentration is also on the rise in intangibles-intensive industries, with less churning at the top. While all firms can benefit from using data, evidence suggests that to date, larger firms have been better placed than SMEs to make the necessary investments needed to convert data into productivity benefits. This has enabled larger, digitally adept firms to capture increasing market shares.

Data play a role in shaping competitive dynamics in markets

The broader effects of the use of data and other intangibles have added to concerns about the competitive dynamics of digital markets across the OECD. Data are an input into production, so firms that control data can have market power and impede the entry of would-be competitors. The effect of such behaviour could be strengthened through mergers, where data collected in one market could be leveraged in another.

Combining complementary datasets could also give rise to an advantage that would be difficult for would-be competitors to overcome. These concerns are especially prominent with respect to large firms active in multiple related markets, including those operating digital ecosystems of interrelated products.

Recommendations

Consider policies to enhance access to and sharing of data, notably data portability measures, to foster competition and enable firm-level data use

Data portability mechanisms, which enable data transfers to third parties, have been found to enhance access to and sharing of data across digital services and platforms. At the same time, they strengthen the control rights of individuals and firms. The potential benefits of data portability for competition are also wide-reaching: they can give new entrants a fighting chance where data access is holding them back, while empowering consumers by reducing the frictions and limited information that hamper their decision making.

Consider policies to enable laggard firms, especially SMEs, to use data, focusing on investment in skills, organisational capital and digital technologies

Policies to promote both technical and management skills may be increasingly important for firms to process and analyse data and enable them to grow and thrive. Financial constraints, however, could be a barrier to firm investments. Policy makers could consider a cross-cutting approach to develop venture capital markets and equity markets, as well as to better target public support, including government funding and tax incentives for research and development. SMEs, in view of their unique characteristics, may need tailored policies to realise such investments.

Consider the role of data in shaping competitive dynamics

The growth of data collection in some firms has raised concerns that control of data could emerge as a source of market power. The same concerns exist due to the non-rival nature of data that enables data to be repurposed for other products in multiple markets. Competition authorities should therefore consider how firms' control and use of data can shape competitive dynamics.

Collaboration between regulators is needed

Digital transformation has broken down sectoral boundaries and created new and complex sets of trade-offs, synergies and tensions that require new policy approaches. As firms collect and use data, their actions and choices may fall into the remit of competition, consumer protection and privacy enforcement policies. Collaboration between regulators can help to foster the development of resilient and coherent data-related policy frameworks.

1 Data: An essential ingredient to digital transformation

Data have become a strategic asset to firms, affecting operations, value and the marketplace itself. This section introduces data as an essential ingredient in digital transformation, noting that large firms have been using data more strategically than their smaller counterparts. It describes the role of productivity growth in stimulating economic growth, and reflects on the role of policy makers to encourage sharing and re-use of data across the economy. Finally, it outlines the flow of the report, highlighting how firms use data (or not) to boost innovation and transform industries, and the need for policy makers to consider these implications.

As digital transformation continues, data have emerged as a strategic asset to firms, affecting how they operate, add and capture value, as well as the broader markets in which they operate. Data can act as an input into production, for example, when combined with digital technologies like artificial intelligence. When analysed to generate insights, data can enable innovation, promote efficiencies and yield increasing returns to scale. In addition, data are non-rival and can be used by many actors and machines simultaneously. Consequently, the greater use and re-use of data by firms could deliver broad economic benefits by facilitating development of more new products and business models.

While the potential of data use is increasingly recognised, empirical evidence indicates that data-processing digital technologies have not been widely adopted across the full spectrum of the firm population. Small and medium-sized enterprises (SMEs) in particular are falling behind. Meanwhile, the

growing use and increasing control of data by highly productive firms at the technological frontier, including those with data-driven business models, raise concerns about competition. The growing gaps between firms point to a slowdown in technology and knowledge diffusion. This has been identified as a key factor in slowing productivity growth across the OECD and threatens long-term inclusive growth and well-being.

Greater productivity allows economies and societies to benefit from a wider range of outputs with the same level of input. Productivity growth is the most important factor in increases in living standards (OECD, 2015[1]). The varying rates of productivity growth between firms have been linked to wage inequality (Berlingieri, Blanchenay and Criscuolo, 2017[2]; Criscuolo et al., 2021[3]), and may be related to the trend towards greater income and wealth inequality in advanced economies in recent years. Competitive and contestable markets are essential to delivering lower prices, higher quality goods and more innovation to consumers. Increasing the ability of firms to thrive in the digital environment and use data more productively is therefore instrumental to long-term prosperity and welfare.

Policy makers should encourage the use of data in a wider part of the business population to harness the benefits of increased productivity and innovation. To do this, policy action should be targeted towards efforts that open data and encourage their sharing and re-use across the economy. Policies can enable businesses to make the complementary investments needed to leverage data. This includes investments in digital technologies like cloud computing, as well as other important prerequisites like skills and organisational capital. SMEs, in particular, may need targeted assistance in restructuring and adapting to the new environment. Meanwhile, competition enforcement authorities may need to give greater consideration to the role of data in shaping competitive dynamics. Finally, a high share of firms analysing data report using data sourced from the individual usage of digital products. Consequently, regulators that enforce privacy and competition policies may need to work together to ensure policy aims and enforcement are coherent.

The next section of the report highlights how firms increasingly generate, collect and use data, and how that use can enable firms to boost innovation, spur productivity and enable new business models. However, there are important gaps in firm-level use of data, particularly for SMEs. Section 3 addresses how the use of data is transforming industries, including productivity dispersion between firms, as well as growing concentration. The implications of these dynamics for competition policy are also discussed. Finally, building on this discussion, section 4 concludes with policy considerations.

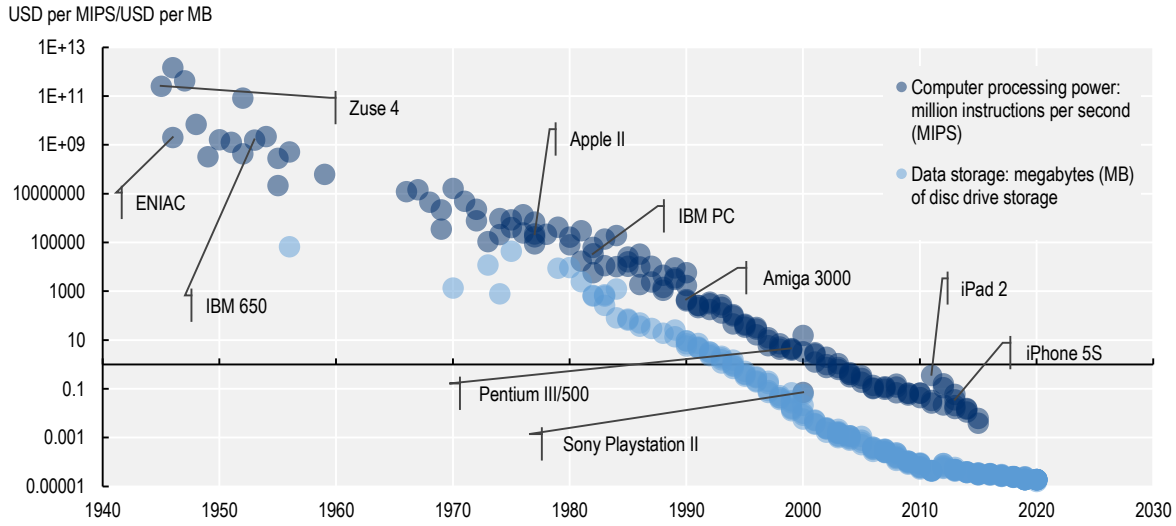
2 Firms use – and are transformed by the use of – data

As firms embed digital technologies into their activities, they increase their ability to generate and collect data. Processing this data, including with technologies like data analytics and artificial intelligence, can prove transformative for productivity and innovation. This potential is exemplified by highly successful, data-driven businesses and their business models. This section examines how firms increasingly generate, collect and use data; and how using data can boost innovation, productivity and enable new business models. This section examines the gap between large and small and medium-sized enterprises with respect to data use and explores the gender divide in digital entrepreneurship.

2.1 Firms increasingly generate, collect and use data

Firms increasingly use digital technologies in every part of their businesses, including to buy from and sell to customers or other businesses through e-commerce, as well as software to manage enterprise resources, customer relationships and supply chain management. Deployment of these digital technologies brings more opportunities to gather and collect data, both from their customers and on their internal operations (OECD, 2021[4]). Because the value of data often increases with its aggregation and combination with other forms of data, firms have incentives to collect data even without immediate plans for their use. Moreover, the falling costs of data storage and processing technologies have made it easier for firms to collect and leverage data (see Figure 2.1). These data are a source of potential value, which is usually realised after the data are cleaned, structured and eventually processed.

Figure 2.1. Cost of computer processing power and data storage, 1940-2020



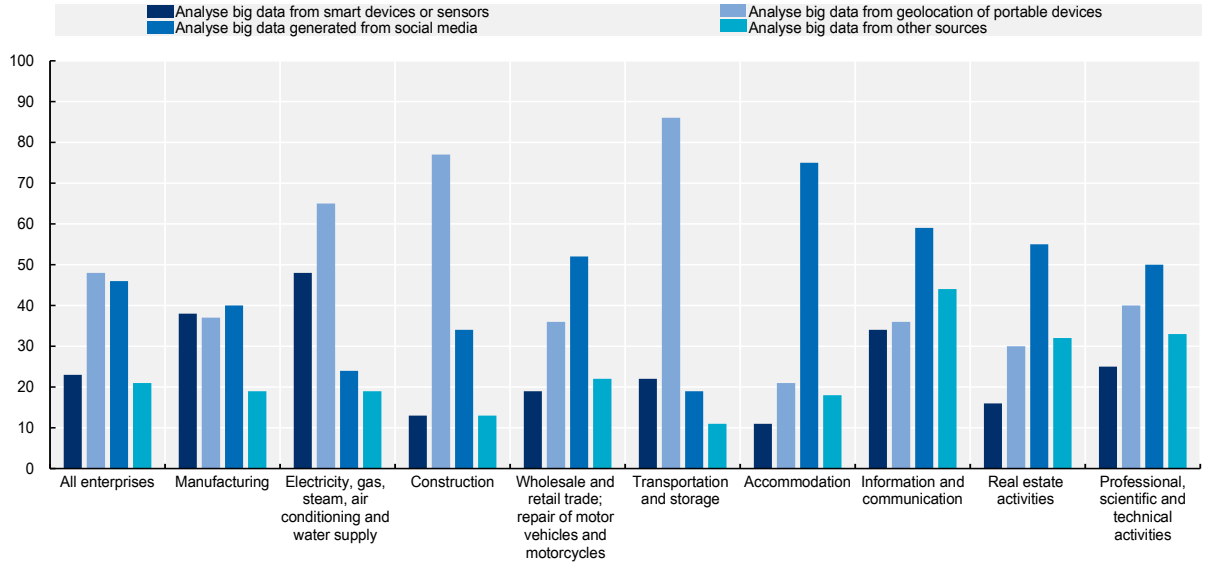
Note: MB: megabyte; MIPS: million instructions per second. Costs are deflated using the consumer price index (US Bureau of Economic Analysis, 2022[5]).
Source: OECD (2022[6]), based on data collected by Moravec (2022[7]), "Processor List" https://frc.ri.cmu.edu/~hpm/book97/ch3/processor.list.txt and McCallum (2021[8]), "Memory Prices 1957+", https://jcmit.net/memoryprice.htm.

As the technical ability to generate and collect data has increased over time, so too has the *use* of this data, with technologies like big data analytics and artificial intelligence (AI) (OECD, 2021[4]). Official statistics show that firms tend to use a variety of data in their operations. Unsurprisingly, firms in different sectors may derive value from different kinds of data. In the European Union, for example, transportation and storage firms that analyse big data most often report using geolocation data from portable devices. Of European firms that analyse big data, 48% examine them from social media and 46% analyse data from the geolocation of portable devices (see Figure 2.2). Data from social media and portable devices are often derived from individual usage of digital services and products. As such, the data may be relatively more likely to be personal (i.e. related to an identified or identifiable individual).

Firms can use data in almost every aspect of their businesses to create value. Data-driven applications now exist for firms in all corners of the economy, with the potential to drive considerable benefits (as will be explored in section 2.2). Data can *enhance* many basic business functions carried out by firms across industries. They do this through efficiency gains and greater potential for innovation, differentiation and specialisation. The use of data can be useful even where a core business model does not rely on the access and use of data (Nguyen and Paczos, 2020[9]) (Table 2.1).

Figure 2.2. Many firms across sectors analyse user-related data when performing big data analysis

Firms analysing big data by source as a percentage of firms analysing big data internally or externally, by sector, European Union (27), 2020 or latest available



Note: Data from social media and portable devices are often derived from individual usage of digital services and products. As such, they may be relatively more likely to be personal (i.e. related to an identified or identifiable individual). Data encompass firms with ten or more employees and self-employed persons. Data on "All Enterprises" exclude the financial sector.
Source: OECD calculations based on Eurostat (2022[10]) *ICT Usage in Enterprises Database* (database), https://ec.europa.eu/eurostat/web/digital-economy-and-society/data/database (accessed 19 September 2022).

Table 2.1. How can firms put data to work?

Data applications	Sectors of application	Relevant business function	Expected impact on business operations	Potential benefits for firms
Customer profiling	Retail trade; food and accommodation services, ICT services, transport	Marketing, sales, product development	Identification of behavioural shopping patterns such as purchasing similarities between customers to predict their preferences towards new items. Better response to customer demand and preferences in product conception and early development. Optimisation and targeting for micro-segments of customers.	Mass customisation and product differentiation; improved sales and marketing opportunities; Higher sales revenues by exposing customers to new or customised products.
Design and conception	All sectors, e.g. construction	R&D, product development	Generative designs using data and data processing to enable rapid and iterative creation. Data analysis for internal research purposes.	Product differentiation and cost efficiency in design.
Pricing strategies	All sectors, e.g. retail trade	Marketing, sales, finance/budget	Evaluation of sources of sales lift and plan future promotions; together with greater anticipatory capacity of input cost fluctuations.	Higher profits through more optimal pricing strategies.
Consumption analytics	All sectors, e.g. construction manufacturing	Procurement, production and distribution	Maximisation of yield/throughput of individual assets by optimising working parameters. Optimisation of input consumption i.e fuel. Better management, monitoring and reporting of input consumption i.e. energy Improved input price and forecasting accuracy; resource optimisation and waste reduction by design.	Higher productivity through cost efficiency. More reliable data reporting for investors.
Predictive maintenance	Manufacturing; transport services,	Production, logistics and	Reduced machine downtime. Automation of safety control processes. Improved supply operations.	Higher productivity through cost and time

	construction	distribution	Optimisation of building operations and maintenance.	efficiency and increased production output.
Quality management	Manufacturing	Production	Optimisation of testing and quality assurance processes. Real-time monitoring replacing manual inspections.	Higher productivity through cost efficiency and improved product quality.
Network and system management	Transport, manufacturing, automotive industry, tourism, retail and wholesale trade; construction	Logistics; supply chain management, production	Analysis of network traffic in real time, including e.g. geospatial distribution of demand or congestion risks. Real-time monitoring of the mobility system (smart traffic systems) and improved real-time fleet management. Inventory optimisation: enhanced real-time inventory tracking and stock management and greater capacity for just-in-time production/delivery. Adaptive, real-time control and increased co-ordination over an ever-expanding array of activities. Dynamic definition of optimal setup point (e.g. sales mix, value allocation, procurement mix) to maximise profit per hour. Enhanced integration of operational systems throughout the value chain.	Cost efficiency (e.g. maintenance, insurance, fuel, etc.), new business models (e.g. taxis, trucks and delivery services, with implications for the automotive industry and the chains of part suppliers).

Note: This table is indicative, and does not provide an exhaustive list of data uses. ESG: Environment, Social, Governance. ICT: Information Communications Technology.
Source: OECD (2022[11]) *Financing Growth and Turning Data into Business: Helping SMEs Scale Up*, based on (OECD, 2021[4]) and (OECD, 2019[12]).

2.2 Using data can boost innovation, productivity and enable new business models

Using data has a range of benefits for firms, including spurring innovation, boosting productivity and enabling more data-driven business models. For firms, data can play multiple intertwined roles. In some cases, data can be analysed to yield insights that can enhance the productivity of other inputs, like labour or capital. In other cases, data can act as a direct *input* into firm activities, like the innovation process, or into the development of digital services.

Data and their analysis can enable faster and cheaper experimentation and faster sharing of ideas, which facilitates innovation. Recent OECD analysis on microdata from France, Italy, the Netherlands and Sweden confirms that firms carrying out big data analytics are more likely to innovate. These innovations are notably in products but also in processes, marketing and organisation. For example, Swedish service firms performing big data analytics with data from geolocation of portable devices were 26 percentage points more likely to innovate in products (Gierten et al., 2021[13]).

Furthermore, firms can use data for productivity and efficiency benefits. As outlined in Table 2.1, there are multiple channels for data to improve productivity within firms. Data and insights from data processing can enable better and more strategic management decisions. In addition, data can be an input into digital technologies that can automate and streamline operations.

A body of literature offers empirical insights on the relationship between the use of data and firms' performance. For instance, DeStefano, Kneller and Timmis (2020[14]) found that small firms in the United Kingdom that adopted cloud technologies were more likely to experience growth in both employment and revenue. Similarly, Tang, Huang and Wang (2018[15]) explored the adoption of the Internet of Things (IoT) at firm level. They found that, controlling for industry, IoT adopters tend to display on average better financial performance (including return on assets, asset turnover and profit margins) than non-adopters. Lastly, Müller, Fay and vom Brocke (2018[16]) found that adoption of assets related to big data was associated with an average improvement in firm productivity of 3-7%. For larger or more

geographically distributed firms, data and data analytics can also be integral to co-ordinating production processes in multinational enterprises and global value chains (Cadestin et al., 2021[17]). This last factor underscores the importance of fostering cross-border data flows with trust (OECD, 2022[18]).

Data use can also be transformational for firms. Some firms are *enabled* by data: namely, their business would not exist without access to and use of data (Nguyen and Paczos, 2020[9]). Online platforms are examples of data-enabled firms at the frontier of markets and technological development. For many of these prominent platforms, their core product is a data-enabled service that connects multiple "sides" of a market, such as consumers, merchants and advertisers. This "matching" service is enabled by the quantity and quality of available data, which are often collected from individual interactions with the platforms. Many popular online platforms offer products at zero price to at least one side of the marketplace. Their main revenues stem from advertising (targeted using data) or successful transactions (e.g. a commission from a successful data-driven match), incentivising greater data collection (OECD, 2022[19]). Many global companies provide zero price products and services (to at least one side) using this kind of business model (OECD, 2022[19]).

Platforms enjoy significant direct and indirect network effects where economies of scale benefit users on multiple sides of the market. In other words, as the number of users on one side increases, the value of the product to users on other sides also increases. Because the marginal cost of adding an additional user to the platform can be close to zero, online platforms can rapidly scale up and expand their geographic coverage. This enables transactions between far-flung users that were previously impossible (OECD, 2019[20]; OECD, 2022[19]). As platforms scale up, so too do their opportunities to gather data to improve their services. This potentially drives a feedback loop that could result in few players in a given market. This is also known as a "winner takes most" or "winner takes all" effect, as discussed in sections 3.2 and 3.3.

New applications of distributed ledger technologies (DLTs) also highlight how data could transform firms and industries. For example, the use of DLTs in digital financial applications ("FinTech") could change how sustainability data are managed, shared and used. In so doing, it could address data-related challenges in environmental and sustainability applications (Box 2.1).

Box 2.1. The use of distributed ledger technologies for the sharing and reporting of sustainability data

Investors increasingly seek long term risk-adjusted return and alignment with sustainability and climate-related objectives through Environmental, Social and Governance (ESG) investing. However, market participants often lack consistent data, comparable metrics, and transparent methodologies to inform their decision-making.

Leveraging their potential for enhanced transparency and auditability, the deployment of distributed ledger technologies (DLTs) could help to store relevant sustainability data and make it accessible. For example, DLTs could enable the publication and dissemination of data about companies' sustainability practices that may not be otherwise readily available. Similarly, the potential immutability and irrevocability of DLTs (depending on the design characteristics) could help to enable the tamper-proof, real-time tracking of data provided, where appropriate, by multiple stakeholders across multiple jurisdictions, for example of greenhouse emissions. Better access to and management of such data could enable the development of more granular and transparent evaluations by stakeholders of ESG performance. Accessibility for relevant DLT participants to timely and sufficient historical data is a prerequisite for the use of such tools to monitor corporates' delivery on their sustainability commitments.

DLTs also have broader use cases for efficient and auditable reporting of sustainability and ESG data to both markets and regulators. For example, DLTs for tokenised forms of sustainable finance capital market products could improve sustainability data transparency and credibility. The BIS Innovation Hub, in cooperation with the Hong Kong Monetary Authority, successfully concluded Project Genesis 1.0, a prototype digital platform for tokenised green bond issuance. In this proof-of-concept exercise, the use of DLTs, among other innovations, allowed investors to track the project's positive environmental impact in real time through an application. Conceptual academic frameworks also suggest that DLTs may facilitate the automation of key compliance processes whereby regulators can access compliance data in near real-time. DLTs could help firms seeking to lower their compliance costs with streamlined, efficient and effective sustainability data reporting, particularly as this becomes a priority for more jurisdictions.

Nevertheless, numerous challenges remain in the deployment of DLTs for sustainable finance and ESG investing use cases. The adoption of DLTs will not address the impediments that arise from data that is fragmented or not interoperable, particularly for investors wishing to benchmark or compare ESG performance. Regulatory use of DLTs would also require skills and other investments in the supervisory community. Because the quality and accuracy of data introduced into DLTs is not guaranteed, users may risk using incorrect, inaccurate or even fraudulent data, although automated data reporting from connected devices, or data certification from independent third party verifying authorities, could mitigate this risk. The data quality governance challenge is important, particularly in light of the potential for real-time, near-tamper-proof data reporting. Other limitations of DLTs are associated with the technology rather than the use-case, including scalability; digital security; privacy; and the environmental impact of the use of certain forms of consensus mechanisms in DLT-based networks. Managing such challenges are essential to realising the potential of DLTs for data collection, sharing and reporting in financial markets, particularly the sustainable finance sector. It should also be noted that DLTs are not the only technologies or frameworks supporting access to and sharing of sustainability data (e.g. centralised and digital access to financial and sustainability-related corporate information through the European Single Access Point).

Note: This case study is based on the ongoing Green FinTech project of the OECD Committee on Financial Markets and its Experts Group on Finance and Digitalisation.

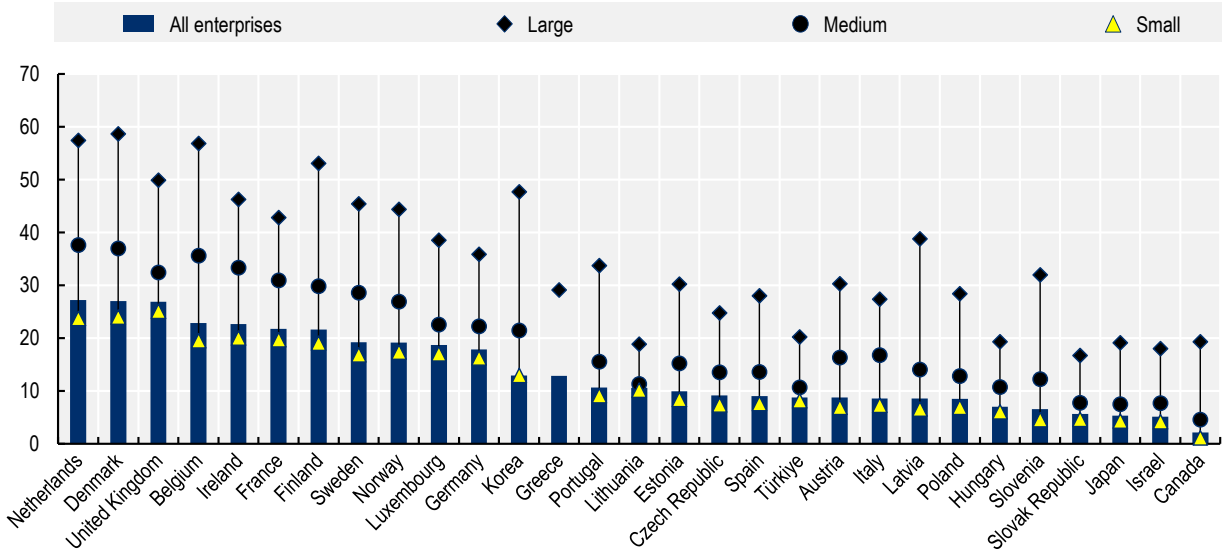
Source: OECD (forthcoming), *Artificial Intelligence for ESG Investing and Sustainable Finance*; ECD (forthcoming), *Green FinTech: Opportunities and limitations of AI, DLTs and other financial innovation for sustainable finance and ESG investing;* OECD (2021[21]), *Artificial Intelligence, Machine Learning and Big Data in Finance Opportunities, Challenges and Implications for Policy Makers*, https://www.oecd.org/finance/financial-markets/Artificial-intelligence-machine-learning-big-data-in-finance.pdf; OECD (2020[22]), *OECD Business and Finance Outlook 2020: Sustainable and Resilient Finance*, https://www.oecd-ilibrary.org/finance-and-investment/oecd-business-and-finance-outlook-2020_eb61fd29-en; Axelsen, Rude and Ross (2022[23]) "DLT Compliance Reporting", http://dx.doi.org/10.2139/ssrn.4124229.

2.3 Some firms use data more than others

Despite the benefits, many firms still lag in their use of data. Specifically, large firms tend to be at the forefront of efforts to adopt digital technologies, while SMEs have fallen behind. For example, recent research found the share of large firms performing big data analysis was more than three times that of their smaller counterparts (OECD, 2020[24]) (see Figure 2.3). The gaps in adoption between small and larger firms are higher for data analytics than for other technologies, like online interactions with government, electronic invoicing, social media or e-commerce (OECD, 2021[4]). Smaller firms have managed to advance in their adoption of more simple and process-based digital technologies, such as the use of a website to make online purchases or the use of software to organise enterprises processes or manage their relationships with customers. However, they still lag behind their larger counterparts in the adoption of advanced digital technologies (Gierten et al., 2021[13]).

Figure 2.3. SMEs lag behind in their use of data

Share of business performing big data analysis, as a percentage of enterprises in each business class, 2020 or latest year available

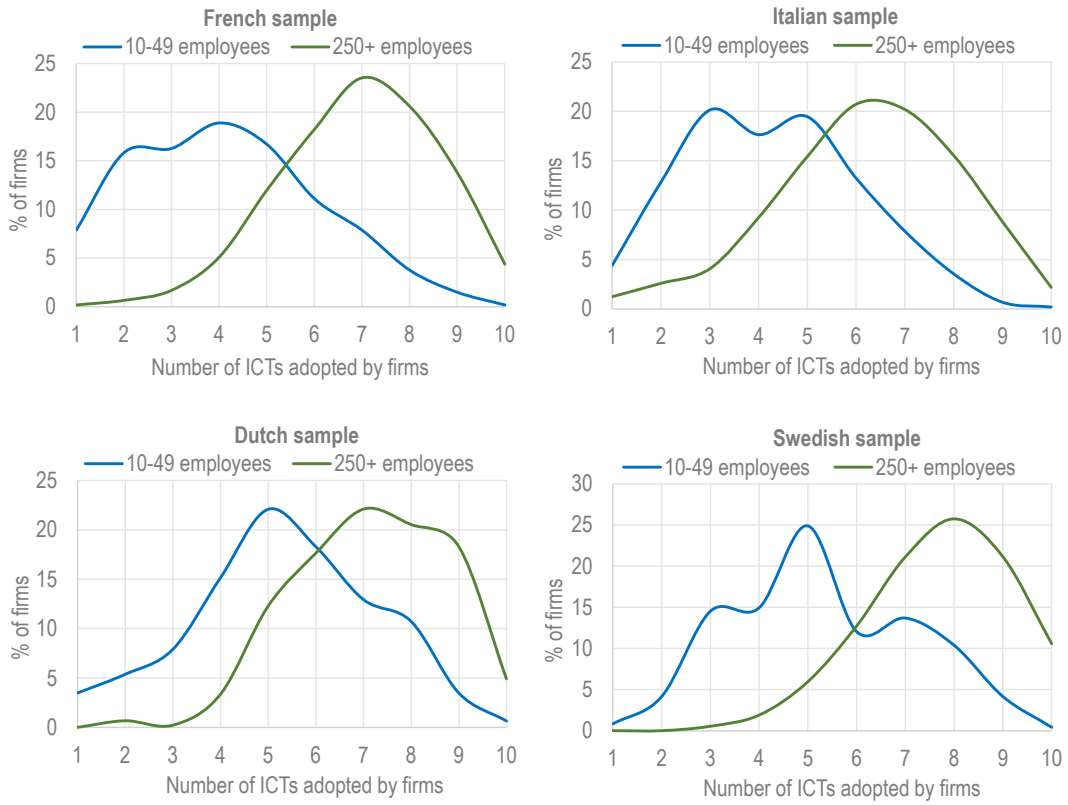


Note: Business size classes are defined based on employment. Small enterprises (10-49 persons employed), medium-sized enterprises (50-249) and large enterprises (250 or more).
Source: OECD (2022[25]), *ICT Access and Usage by Businesses Database* (database), http://oe.cd/bus (accessed 15 May 2022)

Even when they digitalise, smaller firms also tend to use *fewer* digital technologies than their larger counterparts (see Figure 2.4). This is of concern because firms tend to adopt digital technologies in bundles because their functions are complementary. For example, opportunities for unlocking the value of data

often come through the use of a combination of digital technologies: a firm may need to use connected devices or social media to collect data; analytics and AI to analyse this data; and cloud computing to eventually store it for further use (OECD, forthcoming[26]). In particular, cloud computing is viewed as highly complementary to data analytics because it enables scalable access to the computing and storage resources needed to process data (see Figure 2.5). Coupled with evidence that small firms tend to adopt more simple digital technologies, limited adoption could indicate a lack of sophistication or skills necessary to take advantage of the use of data.

Figure 2.4. Large firms tend to use more digital technologies than small firms

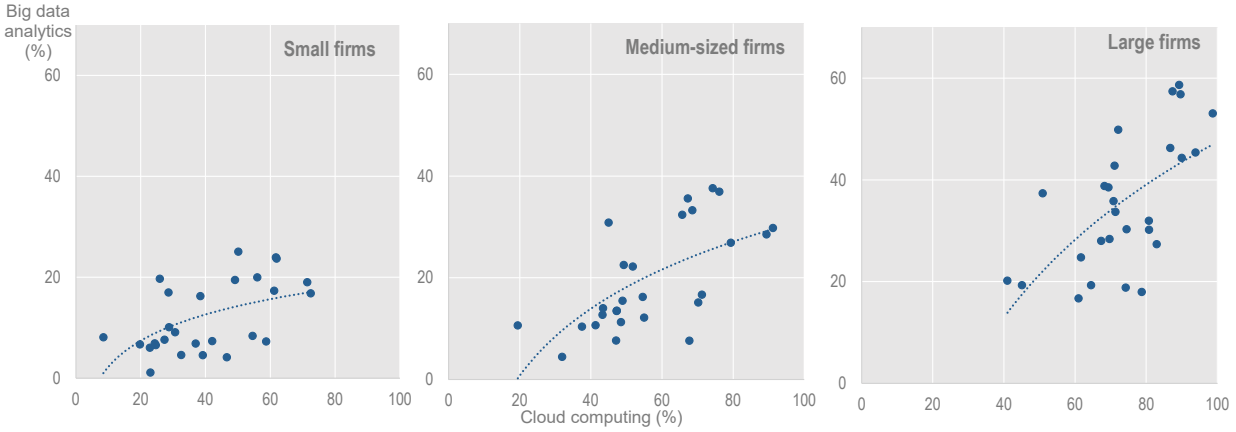


Note: See endnote 1.
Source: Gierten et al. (2021[13]), "Firms Going Digital: Tapping into the potential of data for innovation", *OECD Digital Economy Papers* No. 320, https://dx.doi.org/10.1787/ee8340c1-en.

The COVID-19 crisis prompted a general increase in the adoption of digital technologies as more economic and social activities were forced to move online. Evidence from the OECD indicates that many SMEs also adopted digital technologies during the COVID-19 pandemic (OECD, 2021[27]; OECD, 2021[28]). For example, a survey of more than 35 000 SMEs with Facebook pages found that 64% of medium-sized firms and 51% of small firms reported increasing their use of digital tools between the beginning of the pandemic and the end of 2020 (OECD, 2021[4]; Facebook/OECD/World Bank, 2020[29]). As outlined in section 2.1, the increased adoption of digital technologies is likely to enable the greater generation and collection of data, especially since these changes are poised to be permanent (OECD, 2021[27]).

Figure 2.5. Cloud computing appears to be complementary to big data analytics

Percentage of firms using big data analytics and cloud computing, 2021 or most recent year available



Source: OECD (2022[25]), *ICT Access and Usage by Businesses Database* (database), http://oe.cd/bus (accessed 15 May 2022), based on OECD (2021[4]), *The Digital Transformation of SMEs*, https://dx.doi.org/10.1787/bdb9256a-en.

Despite this trend, other evidence suggests significant heterogeneity in technology adoption following and during the COVID-19 pandemic, with most investments occurring on the intensive margin. Firms that were already somewhat digital had stronger investments in digital technologies than more analogue firms (Bloom et al., 2020[30]; Riom and Valero, 2020[31]; OECD, 2021[32]; Calvino et al., 2022[33]). In other words, the COVID-19 pandemic did result in an overall increase in the adoption of digital technologies in firms. However, it also appears to have reinforced pre-existing digital divides, and most likely gaps between firms that use data and those that do not. This suggests that SMEs may have fallen further behind.

How SMEs adopt data-driven business models may vary significantly across different parts of the economy: the low digital maturity of some sectors could affect the firms active within them. In the OECD, SMEs represent most businesses in sectors where data analytics and machine learning are poised to have a tremendous impact in the near future. This includes retail, transport and logistics, travel, automotive and assembly, and consumer packaged goods (OECD, 2019[34]; OECD, 2021[4]). However, the low digital maturity of some sectors may inhibit SMEs from adopting data-driven business models. For example, a Swedish study in 2019 identified the transportation and storage sector and the road transfer of goods sub-sector as a target for policy action to encourage SMEs to adopt data-driven business models. This was due both to the prevalence of SMEs in this sector and the sector's relative digital maturity, as evidenced by the availability of real-time data sets. On the other hand, the study argued the low digital maturity of the hospitality and construction industries, for example, made SMEs in these sectors less conducive to data-enabled business models (Tillväxtverket, 2020[35]). This conclusion suggests that the sector and context matter for the adoption of digital technologies and data for smaller firms, a crucial insight that should inform policy efforts (OECD, 2022[11]).

Other divides also persist in the use of data and digital technologies. For example, while women are generally less likely to start businesses than men, empirical evidence suggests this gap is larger for digital and data-driven firms (see Box 2.2).

Box 2.2. Who starts digital and data-driven firms? The gender divide in digital entrepreneurship

Women are less likely than men to be involved in starting and managing new businesses. Over 2016 to 2020, less than 5% of women were involved in creating a business or managing a business less than 3.5 years old, compared to 8% of men. The gender gap in entrepreneurship and firm ownership was likely magnified during the COVID-19 pandemic. In August 2020, women in Europe were 20% more likely than men to report they had closed their business.

The challenges faced by women when starting a business seem to be larger for digital entrepreneurship. Using data from Crunchbase, which primarily tracks digital start-ups used to match investors and founders, the OECD found that when women founders seek venture capital, they are 5-10% less likely to receive funding than their male counterparts. Those women who do receive funding receive just two-thirds of the sums that men receive.

These gaps have long-term consequences. In collaboration with UNESCO and the Inter-American Development Bank, the OECD identified that a lack of diversity in digital entrepreneurship could reduce the ability of digital systems and products to cater to the needs of diverse users. This creates the potential to introduce or perpetuate biases and stereotypes. These gender gaps represent a missed opportunity for economies and societies, and could stymy the long-run potential of digital transformation and data use for growth and well-being.

Source: Lassébie et al. (2019[36]), "Levelling the playing field: Dissecting the gender gap in the funding of start-ups", *OECD Science, Technology and Industry Policy Papers*, No. 73, https://dx.doi.org/10.1787/7ddddd07-en; OECD/European Commission (2021[37]), *The Missing Entrepreneurs 2021: Policies for Inclusive Entrepreneurship and Self-Employment*, https://dx.doi.org/10.1787/71b7a9bb-en; UNESCO, OECD, IDB (2022[38]), *The Effects of AI on the Working Lives of Women*, http://dx.doi.org/10.18235/0004055.

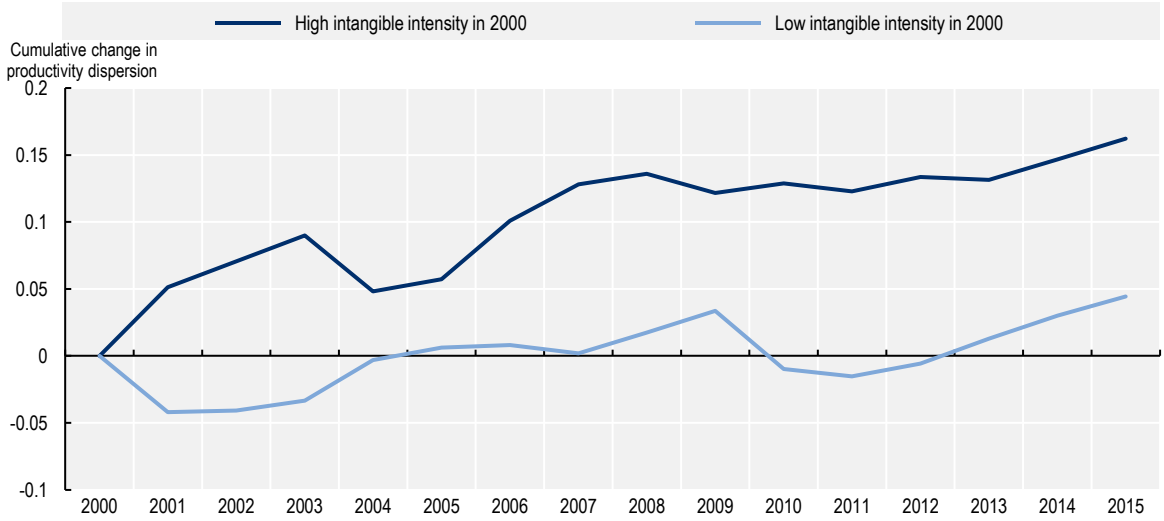
3 The use of data is shaping markets

This section paints a broad picture of the effects of firm-level investments in data and other intangibles on productivity dispersion, industry concentration and competitive dynamics. While all firms can benefit from using data, evidence suggests that larger firms have been better placed to convert data into productivity benefits than their smaller counterparts. This section examines how growing investment in intangibles like data may be increasing industry concentration, with benefits flowing to larger firms. This section finishes by examining how these dynamics have given rise to concerns about competition

3.1 Investments in data and other intangible assets have been linked to productivity dispersion between firms in industries

As outlined in sub-section 2.2, the use of data holds promise for improving productivity performance in firms by enabling innovation and reducing the costs of a range of business processes. However, despite the promises of digital transformation and the wide uptake of digital technologies, aggregate productivity growth has slowed over the 21st century, a phenomenon often called the "productivity paradox" (OECD, 2019[39]). Previous OECD work has noted the overall decline in aggregated productivity growth has masked substantial heterogeneity within countries and sectors and increasing *productivity dispersion*, meaning growing gaps in multi-factor productivity growth between the best performers and other firms (Andrews, Criscuolo and Gal, 2016[40]; Berlingieri, Blanchenay and Criscuolo, 2017[2]; Berlingieri et al., 2020[41]). This appears to be due to two main trends. On the one hand, leading firms that make innovative use of digital technologies are pushing out the technological frontier. On the other, the productivity growth of a long trailing tail of laggard firms with limited capabilities of, or lack of incentives for, adopting new digital technologies, has stagnated (Andrews, Criscuolo and Gal, 2016[40]; Andrews, Nicoletti and Timiliotis, 2018[42]).

Figure 3.1. Evolution of within-industry productivity dispersion by intangibles intensity



Note: Estimation is based on the OECD MultiProd database in combination with INTAN-Invest. Countries included are AUT, BEL, DEU, DNK, FIN, FRA, IRL, ITA, NLD and PRT. The graph plots the evolution of productivity dispersion for high and low intangible intensive industries, after controlling for other factors driving productivity dispersion including average gross output, capital and labour inputs and capital-labour ratios. Country-industries are ranked by their intensity of intangible investment in the year 2000. Country-industries above the median are classified as "High intangibles intensity", country-industries below the median as "Low intangibles intensity". Averages weighted by gross output across two-digit industries are shown for both groups, normalized to 0 in the starting year. Productivity dispersion is measured as the difference in productivity between firms at the 90th percentile of the productivity dispersion and firms at the 10th percentile. The vertical axes represent log-point differences from the starting year.

Source: Corrado et al. (2021[43]), "New evidence on intangibles, diffusion and productivity", *OECD Science, Technology and Industry Working Papers*, No. 2021/10, https://dx.doi.org/10.1787/de0378f3-en.

Recent evidence from the OECD indicates that the use of intangible assets, like data, within industries, may be playing a role in these dynamics. Using a novel dataset combing cross-country data on productivity dispersion within industries with cross-country data on sectoral level intangible investment, recent work from the OECD shows that industries with higher levels of intangible investment experienced higher productivity dispersion between firms relative to other industries. Figure 3.1 shows that productivity dispersion increased approximately 17% over the ten years to 2015 for the group with high intangibles intensity, while the group with lower intangibles intensity experienced a 5% increase over the same period. On average, an increase in intangible investment of 10 percentage points is linked to an approximately 1.5 percentage point increase in productivity dispersion (Corrado et al., 2021[43]).

These dynamics have been interpreted to reflect a key characteristic of productivity in an increasingly knowledge-based and digital economy (Corrado et al., 2021[43]). Data are highly complementary to digital technology adoption, as outlined in section 2. In other words, digital technologies create data by their function, while a range of upstream and downstream digital technologies to generate, collect, use and store data is often needed to unlock their value. At the same time, data play a key role in other intangible assets, like economic competences and software. These are often needed to use digital technologies productively (Corrado et al., 2022[44]). However, data and other intangibles are often proprietary, and costly to generate or replicate. This could impede the ability of non-digitalised firms to make productivity-enhancing investments. Those firms that are already digitalised, and control intangible assets, may therefore be able to pull ahead of a long tail of firms that lag behind, driving the observed growing gaps in productivity *within* industries.

3.2 Growing investment in intangibles like data may be increasing industry concentration, with benefits flowing to larger firms

Industries across the OECD are becoming more concentrated, with more revenues from industries flowing to a small group of large players (Bajgar et al., 2019[45]). A growing body of work from the OECD highlights that larger firms may have a greater capacity to make productive use of data and other intangibles. This could enable them to pull ahead and take a greater share of revenues and sales.

New evidence on the growing scale of businesses in the United States, Japan and Europe shows that rising industry concentration across 2002-14 is strongly associated with investment in intangibles, including data. The estimated effect of intangible investment intensity was relatively large, and this relationship appears to be stronger in more globalised and digital-intensive industries (Bajgar, Criscuolo and Timmis, 2021[46]). Larger firms at the top of concentrated industries with high shares of intangible investment tended to stay there; namely, increased concentration was associated with reduced churning at the top over the 12-year period examined. A 10-percentage-point increase in industry concentration corresponded to a 0.6-percentage-point reduction in the share of new firms among the top eight (a 4% reduction compared to the mean share) (Bajgar, Criscuolo and Timmis, 2021[46]).

Recent evidence from the OECD finds the link between productivity dispersion (section 3.1) and intangibles is stronger in industries with an already wide disparity in the size of players (i.e. where differences in sales across firms in the industry are larger) (Corrado et al., 2021[43]). Separate analysis finds that in digital-intensive sectors, where firms are more likely to generate data and have access to the technologies to use data, larger firms enjoy a larger relative productivity advantage relative to smaller firms (McMahon et al., 2021[47]). The same paper finds these larger firms tend to have larger mark-ups, a potential source of concern for competition (see section 3.3).

This disparity may exist because larger firms are often better placed to benefit from the use of data than smaller firms, for various reasons:

- Data are highly scalable, with large fixed costs and low (often close to zero) marginal costs associated with their use. As a result, compared with their smaller counterparts, larger firms may be better able to make up-front investments required to translate the use of data into greater productivity improvements (Corrado et al., 2021[43]).
- Larger firms may also be able to collect larger datasets for several reasons. First, they might be able to use their greater degree and volume of digitalised economic activities like e-commerce. Second, they might benefit from their greater use of digital technologies, where data are a by-product. Larger firms are also more likely to be incumbents. As such, they may have already accumulated data through their longer business life.
- Data are non-rival and can be used productively in multiple contexts without depletion. Therefore, they can be leveraged across multiple product and geographic markets. This property may disproportionately benefit larger firms because they tend to be more diversified, and it is often easier to share data within organisations, rather than between them (OECD, 2022[48]). Similarly, larger firms tend to be more globalised (OECD, 2019[39]). They are thus more likely to be able to manage international regulatory complexity, including in the area of cross-border data flows (OECD, 2022[18]).
- Protecting data and/or related data-enabled products and activities may require firms to resort to intellectual property rights (IPRs) (OECD, 2022[49]). However, many of these mechanisms do not apply to data and data repositories to the same extent. Innovation surveys show significant gaps among size classes of firms in using formal IPR mechanisms, such as patents, trade secrets,

trademarks, copyrights and industrial designs (Eurostat, 2021[50]). This may prevent SMEs from securing a return on their investments in this type of intangible asset (EUIPO, 2020[51]).

- Finally, data can give rise to self-perpetuating feedback loops, network effects and economies of scale. As more data are generated, firms can use them to yield insights that can lead to product improvements and/or increases in the scale or scope of operations. This, in turn, can lead to the generation of more data. These can enhance the first-mover advantage of incumbent firms and enable the emergence of "winner takes most" or "winner takes all" effects, with potential effects on industry concentration (OECD, 2021[52]).

Industry concentration stemming from digitalisation, and in particular data usage, has become a growing source of policy concern. These concerns are especially prominent with respect to large firms active in multiple related markets, including those operating digital ecosystems of interrelated products (Bourreau, 2020[53]). For instance, the emergence of large digital conglomerates active in numerous markets may create risks for consumer privacy and choices. This is especially the case if personal data gathered in one market (such as health data sensors) affect services available to consumers in others without their knowledge (such as health insurance coverage). Industry concentration across markets may also exacerbate systemic risks, for example with respect to regulatory compliance, outages or security vulnerabilities in the financial sector (OECD, 2020[54]).

Other broader societal risks identified include concerns relating to firm lobbying and regulatory capture, as well as influence over information, misinformation and the democratic process (see, for instance, OECD (2021[55])). A further area of concern relates to competition, especially the idea that rising sector concentration (and data collection capacity) signals a decline in market competition. The other risks above may, in fact, be exacerbated if a small number of industry players is insulated from competition.

Statistics regarding industry-level concentration are an imperfect measure of competitive intensity. This term relates more to the existence and durability of market power (the ability of a firm to keep prices above the competitive level).[212] However, several additional indicators suggest that market power is indeed on the rise in digital-intensive sectors, and it may have become more durable. In particular, the mark-ups that firms in digital-intensive sectors charge over their costs are on the rise, while new firm entry has declined (Calligaris, Criscuolo and Marcolin, 2018[56]; Calvino and Criscuolo, 2019[57]; Calvino, Criscuolo and Verlhac, 2020[58]). This fall in competitive intensity may be due at least in part to the characteristics associated with data described above (economies of scale and scope, feedback loops, and network effects). These factors may create barriers to entry that insulate larger incumbents from competition (OECD, 2021[52]).

3.3 Data have reshaped competitive dynamics across the OECD

Data affect the competitive dynamics of markets in four main ways. First, they serve as an important input for products and services. Second, they may constitute a dimension of quality from the perspective of consumers (both in terms of the amount of information available to consumers, and the amount of personal data collected from consumers) (OECD, 2016[59]). Third, data may themselves constitute a product that leads to the creation of new markets. Finally, they may be used to facilitate consumer decision making.

With respect to their use as an input, data can be used to improve products and services, and create wholly new ones. This includes applications that may not be envisaged at the time the data are collected (OECD, 2020[60]). The benefits to consumers, and the economy more broadly, can therefore be significant. However, in some cases, these benefits arrive hand in hand with market dynamics that affect competition. For example, "big data" applications require large volumes of data to generate significant value. This means that data access can constitute a significant barrier to entry when this type of analytics is necessary to participate in a market, particularly when alternatives are limited.

More generally, the fact that data exhibit strong economies of scale and network effects can lead to self-perpetuating "feedback loops" that may insulate incumbents from competition (OECD, 2016[59]). Specifically, when the use of a product generates data, these data can be used to attract more consumers. This can occur either by improving product quality or generating revenue through data or advertising sales for product improvements. However, the process may give rise to a cycle that limits entry and increases incumbent market shares. The precise impact of data on the ability of firms to enter markets, and thus the durability of market power, will depend significantly on the market and data in question. For instance, a given type of data will only significantly impede entry under two conditions: it must be indispensable in creating a product or service, and inaccessible through alternative means (see section 4.3).

The role of data as an input, and its implications for competitive dynamics, has been of growing interest to policy makers and competition authorities for three reasons. First, there are concerns that mergers between firms with complementary datasets may give rise to an advantage that is difficult to overcome for competitors (and thus durable market power). This is true even if the two merging firms are not the only two significant competitors in the market at the time of merger (OECD, 2019[61]; OECD, 2020[60]). Further, while competition authorities generally focus on mergers between direct competitors, other types of mergers may also give rise to competition concerns when data are an important input. For example, when a firm controlling an important data source merges with a downstream firm that relies on that data source, it may have the incentive to cut off the downstream firm's competitors from accessing the data (OECD, 2019[62]). Competition authorities face the significant challenge of assessing the post-merger firm's incentives to do so. They must also determine whether the data are sufficiently crucial and difficult to substitute that it would harm consumers. In addition, there is a risk that data may increase the likelihood of conglomerate mergers (mergers between firms that are neither competitors nor in a supply relationship) generating harm (OECD, 2020[63]). For example, personal data collection in one market might be leveraged into market power in a related market, limiting the contestability of both markets (Condorelli and Padilla, 2019[64]).

Second, where data are an important input, and they contribute to the transparency of markets, new risks of collusive behaviour may arise. These risks are amplified in markets where AI applications are used to make business decisions, such as setting prices (OECD, 2021[65]). When firms use the same market data provider to make pricing decisions, for example, conditions may be ripe for them to collude with one another, since they can more easily monitor the implementation of a collusive agreement and detect deviations. High transparency in markets also leads to the risk of tacit collusion – the risk of collusion without an explicit agreement among the firms. This is not easily addressed with current competition policy tools (OECD, 2021[66]).

Third, to the extent that data represent a significant barrier to entry in a market, it could mean that positions of dominance become relatively more common (OECD, 2020[67]). Recent amendments to the German Competition Act have, for example, explicitly incorporated data into the assessment of market power (Bundeskartellamt, 2020[68]). While dominance is not automatically a cause for concern, it does mean that certain conduct by the firm in question can have anticompetitive effects. When data are an important input in a market, dominance may be used to exclude competitors from a market and prevent entry. This is especially the case if the dominant firm controls access to their competitors' data inputs, or attempts to limit competitors' access to data through certain types of exclusivity agreements with customers or limitations on data portability (OECD, 2020[67]).

Given that data collected in one market can be repurposed for other products, there is also a concern that an entrenched position can be extended into multiple markets. In other words, a firm that has accumulated a strong position in a market can use its data access to introduce new products, and potentially build an ecosystem of interconnected products. While this can generate significant benefits for consumers, for instance by enabling seamless data transfers between complementary products, it can also constitute a significant entry barrier: where data access is limited and essential to compete, challengers would need to offer a matching ecosystem of products in order to match an incumbent's position. This may also give rise

to anticompetitive strategies. One such strategy is “privacy policy trying”. In this case, a firm conditions the use of its services on broad data collection permissions that can be used to obtain a formidable advantage in related markets with overlapping consumer bases (Condorelli and Padilla, 2019[64]).

Data also serve as a dimension of quality that affects competitive dynamics. On the one hand, the collection of data can improve product and service quality by, for instance, improving the results of an algorithm. On the other, consumers may perceive the usage and collection of data, including personal data, as detrimental to the quality of a product they use (OECD, 2020[60]).

The impact of data on market dynamics is not always predictable, however. Limitations to data usage and collection are not always affected by competition in the same way as other dimensions of product quality for several reasons. The “free” nature of some digital products, for example, may limit consumer assessment. Firms may also use strategies to impede consumers from taking informed decisions. There may also be a lack of viable higher privacy alternatives , among other factors (OECD, 2018[69]).

These dynamics create significant challenges for competition authorities when they seek to assess the potential impact of mergers or conduct on consumers. Their analytical approaches must be adapted to fully incorporate non-price competition – especially when prices for consumers are zero (OECD, 2018[70]; OECD, 2018[69]), as well as the multi-sided nature of data-centred business models (OECD, 2018[71]). They must also grapple with determining what really matters for consumers when they make product decisions, and thus what relevant measures of data-related quality to consider. They may also consider potential new forms of misconduct regarding dominant firms’ treatment of consumer data. The German Bundeskartellamt, for example, contended that Facebook exploited its dominant position to impose unfair terms on consumers with respect to data collection (OECD, 2020[60]).

Data also play the role of a product. This is especially true in the digital sector, where multi-sided business models rely on the monetisation of data either through their sale, use for targeted advertising, or the creation of new products and services. In their analysis, competition authorities are therefore required to consider whether specific data constitute a separate antitrust market in their own right rather than being just an element of market competition. A separate market requires a separate assessment of competition conditions and market power regarding the sale and purchase of such data (OECD, 2020[60]).

Finally, in addition to their role as an important input, dimension of competition and product, data can also be a powerful tool for consumers to make decisions and spur competition. For instance, in complicated markets such as electricity or banking, data regarding a consumer’s purchasing patterns can help them find the best deal according to their needs. New AI applications can be harnessed for this purpose, collecting different alternatives and comparing them (OECD, 2021[65]). In certain markets, consumers can also use data to multi-home, or use multiple competing services at the same time. By sharing their data (for example, social media content) across different services, consumers can encourage market entry. Policy tools, such as data portability measures, can facilitate both of these outcomes. For example, they can establish common application programming interfaces to facilitate comparison shopping, and make it easier to share data across services. These and other measures will be discussed in the next section.

4 Policies for firms in a data-driven landscape

This section discusses policies to enable firms to succeed in an increasingly digital and data-intensive landscape. In particular, it highlights the importance of access to and use of data for firms, including the many complementary investments that firms must make to fully realise the transformational effect of data and digital technologies. The section also looks at how competition frameworks may need to consider the increasing role of data and other intangibles in firms across the OECD. The section ends with a discussion of the need for increased collaboration between regulatory authorities in areas like competition, consumer protection and privacy enforcement.

4.1 Policies to enhance access to and sharing of data, notably data portability measures, can foster competition and enable firm-level data use

For firms to use data, they need access to them. However, most data are not traded or sold, but rather generated and used within organisations. This can inhibit their more widespread use (OECD, 2022[6]). Data portability mechanisms, which enable data transfers to third parties, have been found to enhance access to and sharing of data across digital services and platforms. At the same time, these mechanisms strengthen the control rights of individuals and firms (OECD, 2021[72]). Significant interest in data portability has also arisen in the competition policy community, in the context of expert panels on digital competition issues and competition authority studies in a range of jurisdictions (OECD, 2021[52]).

Data portability measures take a range of different forms. Recent OECD work defines data portability as a specific form of conditioned data access and sharing arrangement. In this arrangement, a stakeholder (usually the "data subject", or the person identified or identifiable through personal data) can access data (OECD, 2021[72]). Such measures usually vary along five characteristics (see Box 4.1).

Box 4.1. Towards a taxonomy of data portability initiatives

The following five key dimensions can be used to categorise data portability initiatives in the private and public sector:

- Sectoral scope – whether data portability arrangements or initiatives are sector-specific (and thus only directed to data holders in a specific sector), or horizontal (and thus directed potentially at all data holders across sectors and domains). Data protection legislation is among the most prominent vehicles for cross-sector or horizontal data portability; accordingly, such measures tend to focus on personal data.
- Type of data – whether data portability is limited to personal data, and includes or excludes volunteered, observed or derived data.
- Legal obligations and responsibilities – the extent to which data portability is voluntary or mandatory, and if so, how it is enforced.
- Modus operandi – especially in respect to the modalities of the data transfer. This means the extent to which data transfers are limited to or include ad hoc (one-time) downloads of data in machine-readable formats, ad hoc direct transfers of data to another data holder, or real-time (continuous) data transfers between data holders that enable interoperability between their digital services.
- Beneficiaries – whether data portability mechanisms apply to only natural persons (excluding legal persons i.e. businesses) or whether legal persons (i.e. businesses) also have a right to data portability.

Source: (OECD, 2021[72]) "Mapping Data Portability Initiatives, Opportunities and Challenges", *OECD Digital Economy Papers,* No. 321, OECD Publishing, Paris, https://doi.org/10.1787/a6edfab2-en.

There is a range of reasons why the level of data portability in a given market is limited, and sub-optimal from a consumer and societal perspective. The interests of incumbents and new entrants, for example, may diverge. Incumbents may seek to protect their investments, as well as their first-mover advantages obtained from initial data collection. Further, vertical integration and conglomerate business models are common. Consequently, firms holding data may have incentives to limit the access of their competitors to data in downstream or related markets. This is true even if the former they are not currently active in those markets, but plan to enter in the future. There is also a risk that collective action problems may also have hampered firms' incentives to make the investments to enable data portability and develop the associated standards (OECD, 2021[52]).

From a competition perspective, data portability may be a tool for addressing concerns about durable market power stemming from data usage and collection. In particular, policy measures to promote or mandate data portability can be focused on addressing the barriers to entry that new entrants face in some markets. Where data are an important input and determinant of product quality, new entrants may be unable to match the incumbent's products. In other words, the incumbent may have a significant first-mover advantage in data collection, especially where significant network effects are associated with data collection. Further, the access of new entrants to consumers may be limited if consumers face significant switching costs, specifically a loss of data, when trying new digital products and services. Consumers may

also need information about their usage and profile to consider alternatives. Such data portability limitations may hamper their ability to make decisions and compare rival products.

Thus, the potential benefits of data portability for competition are wide-reaching. On the one hand, data portability can give new entrants a fighting chance where data access is holding them back. On the other, it can empower consumers by reducing the frictions and limited information that hamper their decision making. Data portability could also fundamentally change the competitive dynamics in a market. It could move the market from "winner takes most" to one where multiple firms are present and consumers can use many different services ("multi-homing"). However, these benefits will depend on the characteristics of the market in question, and the form that data portability takes.

The characteristics of data portability mechanisms noted in Box 4.1, relative to what is needed by firms to compete in a market, will determine the impact on competition. Considering these factors, notably those related to the scope, format and frequency of data, OECD (2021[52]) suggests that data portability measures are likely to be most effective in promoting competition in markets in which:

- individual-level data provide the most value,
- data are held by incumbents without significant costs,
- there is already some competition present,
- data can be used in clearly defined applications, and
- there are no significant privacy or ownership complexities.

Data portability can be promoted, and preserved, through both ex ante regulatory approaches, and competition enforcement. Sector-specific data portability initiatives have also been implemented or proposed to promote competition. For example, following a market investigation, the UK Competition and Markets Authority put in place the Open Banking initiative. The initiative was in response to a range of factors hampering competition, including complexity faced by consumers when comparing options and switching banking service providers.

Open Banking has implemented continuous data portability through a common application program interface for retail banking services. It facilitates multi-homing by consumers (by enabling them to access their accounts and information through a single platform), unbundling, and comparison shopping services (OECD, 2021[52]).

Some other proposals target firms that are active in digital markets. The European Commission's proposed Digital Markets Act targets large firms that provide "core platform services" and online intermediation services, like browsers, messengers or social media (European Parliament, 2022[73]). The proposed legislation would require designated digital gatekeepers to provide business users with continuous, real-time data portability for data generated by businesses and end users on certain platforms (European Parliament, 2022[74]).

In addition, questions regarding data portability may emerge in the context of competition authorities' enforcement work. So far, these questions have often been part of broader discussions on the interoperability of different systems on a core platform or service (including the cases against Microsoft in the late 1990s) (OECD, 2021[52]). Competition authorities may consider a degradation of data portability by a dominant firm to be abusive conduct, and specifically a strategy to deny rivals access to data. These strategies can, for example, allow a firm to leverage its market power into new related markets, effectively bundling different products together through preferential data portability. The risk of this conduct can also be considered in the context of merger review. This is especially the case for mergers that result in the vertical integration of a dominant data provider with a downstream firm that relies on it for access to data. It is equally relevant to mergers between different firms in related markets connected through data linkages. Finally, data portability can be considered as a remedy attempting to preserve competition in merger cases,

bringing together direct competitors with complementary datasets. However, the underlying incentives of the firms could require close monitoring, and may render the remedy ineffective (OECD, 2021[52]).

4.2 Policies can enable laggard firms, especially SMEs, to use data, focusing on investments in skills, organisational capital and digital technologies

Many conditions impact the diffusion of digital technologies, including access to broadband (OECD, 2021[32]), insolvency regimes (Adalet McGowan and Andrews, 2018[75]) and employment and labour market regulation (Andrews, Nicoletti and Timiliotis, 2018[42]). In addition to these framework conditions, a range of complementary investments enhances the firm's internal capability to use intangible assets like data and reap the relevant benefits. Such investments are necessary to help reap the productivity improvements of data use. They are particularly relevant to SMEs and other firms that tend to lag behind.

Mere access to data is not enough to help firms realise the benefits of data; firms must be able to *use* such data effectively to draw insights and improve decision-making. As highlighted in OECD work, a key barrier to data use in firms is a lack of skills in the digital technologies required to process and analyse these data (OECD, 2021[4]). Skills are also essential in cleaning and refining raw data to ensure they are of sufficient quality to yield actionable insights or predictions. In this respect, the accuracy, usability, relevance and time dependence of data can determine their value to the firm (Iansiti, 2021[76]). Poor quality data can reduce algorithmic performance and result in a decline in created business value (OECD, 2022[49]).

As firms digitalise, data may become relatively more abundant while digital skills may remain a relatively inelastic complement. Policies to promote skills related to data science, therefore, may be increasingly important to enable firms to grow and thrive. Given the importance of organisational processes and the fast-evolving technological landscape, management skills are often needed to realise returns on investments in data. A recent analysis found that policies to strengthen managerial skills to support organisational change, such as mentoring and coaching services, were effective in improving adoption of data-related technologies and boosting productivity (Calvino et al., 2022[33]).

The use of data in firms through data analytics and machine learning goes hand in hand with a range of other digital technologies, not least those needed to store, generate and collect data. This is consistent with how digital technology adoption tends to take place in bundles, with productivity increasing with the number of technologies adopted (Calvino et al., 2022[33]) (see also section 2.3). Some digital technologies, like cloud computing services, have been observed to be highly complementary to data analytics (OECD, 2021[4]). This is most likely because cloud computing enables affordable and scalable processing and storage of data. More generally, greater adoption of advanced digital technologies like the Internet of Things or robotics can help put in place the sensors required to collect valuable raw firm-level data for eventual processing and use.

For firms to make the complementary investments needed to use data – e.g. skills and technologies – they must also operate in an environment with financing conditions that enables such outlays. OECD work in the context of the G20 (OECD, 2021[77]) highlights how increasing the ability of financial systems to ease barriers to financing for intangible assets may help boost productivity of firms. It also shows that systems across the OECD are not well-suited to the particular characteristics of intangible assets, including uncertain returns and non-rivalry.

The most appropriate financing sources may differ for firms. Consequently, a cross-cutting approach to develop venture capital markets and equity markets, as well as to better target public support, including government funding and R&D tax incentives, could be considered. This could help firms lessen their financing constraints and help enhance the contribution of their use of data and other intangibles to productivity (Demmou and Franco, 2021[78]).

Other nascent efforts across the OECD aim to enhance the ability of small and credit-constrained firms to use intangible assets as collateral. Korea, for example, strives to enhance intangibles-backed finance by addressing the lack of confidence in recoverable intangible asset value. It has also introduced measures to reduce the cost, time and complexity of intellectual property valuation (Brassell and Boschmans, 2019[79]; Brassell and Boschmans, 2022[80]).

Policies that encourage SMEs and laggard firms to make such investments may also need to be better targeted. A recent cross-country analysis of 485 policies and 209 institutions across the OECD area provides an overview of government policy mixes to enhance SME access to, protection and exploitation of data. It also examines the institutional and governance arrangements behind them. While policies proliferate, the study shows only 41% are targeted to populations, technologies, regions or sectors. Moreover, only 54% of that share aim to address SMEs. Even fewer target sub-groups like entrepreneurs or young firms (OECD, 2022[11]).

Policies do seek to strengthen SME capacity to use data, including promoting data-related skills. However, relatively few policies are oriented towards SME access to external data, including through data-sharing mechanisms. Similarly, institutions responsible for SME and entrepreneurship policies are rarely and unevenly involved in policy efforts. The current focus on horizontal measures, such as strategies and action plans, involves different institutions for design and implementation. They have a broad range of mandates, and are organised along different governance models (OECD, 2022[11]). These findings suggest that policies may need to go further in targeting SMEs, especially given their position in an increasingly concentrated and data-intensive landscape.

4.3 Competition policies need to consider the role of data in shaping competitive dynamics

The growing prominence of data, and the specific characteristics of dynamics in digital markets, have increased concerns across the OECD about the potential durable market power associated with data. Competition authorities may need to adapt their analytical tools to data-driven business models and the dynamics of markets transformed by firm investments in data and digital technologies. This can include considering multi-sidedness and business models that involve the provision of products at a price of zero, often in exchange for consumer data. Similarly, the role of data in reinforcing demand-side characteristics of a market, including in relation to search and switching costs, and choice and information overload, could further entrench market power for a firm in a dominant position.

The growth of data collection in some firms, and the non-rival nature of data which enables such data to be repurposed for other products in multiple markets, have given rise to concerns that the control of data could emerge as a source of market power. Competition authorities therefore need to consider how firms' control and use of data can shape competitive dynamics. Recent OECD work has identified key considerations for assessing whether data are an input that gives rise to market power, as summarised in Box 4.2.

Box 4.2. Considerations for assessing whether data contribute to market power

Data exhibit some characteristics that set them apart from other inputs. Understanding the contribution of data to market power may therefore require considering several attributes:

- **The precise scope of data being considered:** The data relevant in a given market may be just a subset of a larger database, or may be contained in multiple different databases. The structure of data may also differ significantly across firms. Further, the types of data used by different market participants may vary. Thus, relevant data can be amorphous and difficult to define relative to more traditional inputs.
- **The importance of a specific dataset for competing in a market:** The objective importance of a given dataset for a firm's ability to compete, and thus its contribution to market power if held exclusively, is a fundamental question. It can be divided as follows:
  - ***Are data an indispensable input in the market?*** In other words, can the product be offered to consumers at a competitive level of quality without this type of data? This assessment can consider whether alternative types of data or approaches can be used to provide the product.
  - ***Are there substitutes for the specific dataset held by the firm being assessed?*** The identification of potential substitutes for competitors, or alternative approaches not requiring the data in question, can be challenging. This is especially the case in rapidly developing markets where firms collecting data may not themselves know exactly how it will be applied in the future. One consideration is whether comparable datasets can be purchased from third parties, including data aggregators, and at what cost (Autorité de la concurrence and Bundeskartellamt, 2016[81]).
- **The date of collection and the nature of data flows:** In some instances, a fixed static dataset may be sufficient. In other cases, the continual flow of data is most valuable, and data may in fact have an expiration date in terms of usefulness (Oxera, 2018, p. 8[82]).
- **The quality and accuracy of the data:** Datasets based on inputs from users, or inferences, may have accuracy limitations. Further, there may be measurement errors or data corruptions. Thus, quality and accuracy are crucial to comparison of different datasets and the determination of whether a given dataset contributes to market power (see, for example, ACCC (2019[83])).
- **Whether scale is needed for the data to be useful:** Some datasets are useful on an individual consumer level, whereas others only generate value once they attain a given scale. For example, the marginal value of an individual search engine enquiry is likely to be minimal; the algorithm will require large volumes of data to improve its predictions[3] (OECD, 2016[59]; Autorité de la concurrence and Bundeskartellamt, 2016[81]). In contrast, individual-level data may be of particular value for products like social media platforms, where access to that data is an important part of the platform's value (OECD, 2021[52]). When scale is crucial, or when individual-level data are not portable, data may contribute to incumbent market power.
- **Whether other data, or specific resources, are needed for the data to be useful:** Some datasets may need to be combined with others to be useful. For instance, a given dataset may need to be matched to individual user profiles to be valuable. Further, not all firms in a market may have access to the requisite skills and resources to handle, process and analyse a dataset.

Source: OECD (2022[84]), *The Evolving Concept of Market Power in the Digital Economy*, https://www.oecd.org/daf/competition/the-evolving-concept-of-market-power-in-the-digital-economy-2022.pdf.

4.4 Reinforced collaboration between regulators such as competition and privacy enforcement authorities is needed

Digital transformation has broken down sectoral boundaries and created new and complex sets of trade-offs, synergies and tensions that require new policy approaches. For example, the sections above discuss the new incentives for firms to collect and use data and their potential impact on competitive dynamics. However, these practices may fall into the remit of other policy areas, including privacy enforcement. Similarly, firms that aim to limit the sharing of data with the stated aim of "enhancing privacy on the web" may also be viewed as inconsistent with competition laws in some jurisdictions (CMA, 2022[85]). As mentioned in section 2, firms often analyse user-related data. Of European firms that analyse big data, 48% draw upon social media and 46% examine geolocation data from portable devices. Such data are often derived from individual usage of digital services and products. As such, they may be relatively more likely to be personal (namely related to an identified or identifiable individual), and fall into the remit of data protection regulation.

In response, some OECD countries have tried to increase co-ordination of policy actions. For example, the UK Competition and Markets Authority and the Information Commissioner's Office have increasingly worked together on issues at the intersection of the policy aims to "promote and protect competition in digital markets… [while] protecting the personal data of the users of digital products and services" (CMA/ICO, 2021[86]). Many issues at the heart of policy debates across the OECD, including the proliferation of online platforms and digital advertising, take place at this intersection. This implies the need for greater co-ordination across regulatory authorities, such as those concerned with privacy, competition and consumer protection.

The potential for overlapping regulatory and enforcement measures may have different core objectives, requirements and scope. For instance, measures implemented with a data protection focus may be centred more around informing consumers about the information collected about them, and giving them individual control over that information, rather than defining a set of competitively-useful data to encourage entry. To the extent that one set of measures is already in place, it may be difficult to supplement them with an alternative focus. Consequently, co-operation across disciplines in the design of such measures is crucial (OECD, 2021[52]).

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Notes

1. The figures for the French, Italian, Dutch and Swedish samples include small and large firms that use at least one of the following ten ICTs tools and activities: fixed broadband, website, enterprise resource planning, customer relationship management, e-sales, e-purchases, high speed broadband, cloud computing, social media and big data analysis. The French sample includes firms from ICTS 2016/2017, N=2912. The Italian sample includes firms from ICTS 2016/2017, N=4228. The Dutch sample includes firms from ICTS 2016/2017, N=1345. The Swedish sample includes firms from ICTS 2016/19, N=866. ICTS stands for ICT Usage in Enterprises Survey. The values reported are only representative for the French, Dutch and Swedish samples used for these figures. They may differ from official statistics reported by INSEE France, Statistics Netherlands, Statistics Sweden, Eurostat or the OECD due to different sectoral coverage and aggregation methods (e.g. weighting, imputation, treatment of item non-response, etc.) used for official statistics and/or selection effects in the sample.

2. Competition is generally assessed at the level of markets, defined in terms of the substitutability of products and the geographic area in which they are sold, rather than industries. This is because the competitive pressure faced by firms is determined by the ability of consumers to switch to substitutes, and the ability of new entrants to introduce competing products. A firm's share of an industry's total revenues will be a function of numerous other factors unrelated to these competitive pressures, including the relative size of the markets in which the firm is active, and the statistical definition of the industry's boundaries.

   In fact, competition within markets may become more intense while industry concentration statistics increase as the relative importance of different markets within an industry change (OECD, 2018[87]). For competition policy purposes, any assessment of competition based on concentration of revenue shares in a specific market will need to be supplemented by: (I) an analysis of whether the threat of potential entry, or aggressive competition among the small number of firms in a market, imposes competitive pressure, and (ii) whether the market reflects "competition for the market" dynamics in which firms compete aggressively over the majority of the market (OECD, 2019[88]).

3. While scale may not always improve a search algorithm's results, it may be particularly important for dealing with rare inquiries that have a higher chance of appearing with large volumes.